1988 ANNUAL AMS-MAA SURVEY

(First Report)

Report on the 1988 Survey of New Doctorates, *Edward A. Connors*
Salary Survey for New Doctorates
Faculty Survey: Salaries, Tenure, Women
Doctoral Degrees Conferred, 1987-1988

HIGHLIGHTS

1. *856 doctorates in the mathematical sciences were awarded in the period July 1, 1987, through June 30, 1988, by U.S. and Canadian institutions - 703 (82%) were awarded to men. The total number of degrees is an increase of 7% over the average of the fall counts for the last five years.*
2. *804 doctorates in the mathematical sciences were awarded by U.S. institutions, an increase over the 779 awarded in 1986-1987, but several hundred below the annual numbers awarded in the early 1970s.*
3. *Only 45% (363) of the doctorates awarded by U.S. institutions went to U.S. citizens. This percentage has steadily declined since the late 1970s, when three quarters of the doctorates awarded by U.S. institutions went to U.S. citizens. For the second consecutive year the number of doctorates awarded to U.S. citizens is well below 400. The sum total of U.S. citizen new doctorates for the last two years (725) is less than the total for the single year 1974-1975 (741).*
4. *Although women comprise 21% of the U.S. citizens receiving doctorates, only 16% of the new doctorate hires in the U.S. doctorate-granting departments were women.*
5. *Starting salaries for new doctorates increased by 4.6% over last year for those reporting nine-month teaching (or teaching and research) positions.*

This first report on the 1988 Survey includes a report on the 1988 survey of new doctorates, a report on salaries of new doctorates, salary and other data on faculty members in four-year colleges and universities, and a list of names and thesis titles for members of the 1987-1988 Ph.D. class. The report is based on information collected from questionnaires distributed in May to departments in the mathematical sciences in colleges and universities in the United States and Canada, and later to the recipients of doctoral degrees granted by these departments between July 1987 and June 1988, inclusive. A second round of questionnaires was distributed in September, concerned with data on fall enrollments, class size, teaching loads, and faculty mobility. This data will appear in the second report on the 1988 Survey, in a spring 1989 issue of *Notices*.

For these reports, departments are divided into groups according to the highest degree offered in the mathematical sciences. The groups are described in the Appendix to this report. See April 1988 *Notices*, pages 532-533, for a list of Group I and II departments.

The 1988 Annual AMS-MAA Survey represents the thirty-second in an annual series begun in 1957 by the Society. The 1988 Survey is under the direction of the AMS-MAA Committee on Employment and Educational Policy (CEEP), whose members are Morton Brown, Stefan A. Burr, Edward A. Connors (chair), Philip C. Curtis, Jr., Don O. Loftsgaarden, David J. Lutzer, and Audrey A. Terras. The questionnaires were devised by CEEP's Data Subcommittee whose members are Edward A. Connors (chair), Lincoln K. Durst (consultant), John D. Fulton, James F. Hurley, Charlotte Lin, James W. Maxwell (ex officio), Donald E. McClure, and Donald C. Rung. Comments or suggestions regarding this Survey may be directed to the subcommittee.

Report on the 1988 Survey of New Doctorates

Edward A. Connors

This report presents a statistical profile of new doctorates in the mathematical sciences awarded by universities in the United States and Canada during the period July 1, 1987, through June 30, 1988. It includes the employment status of recipients of 1987-1988 doctorates in the mathematical sciences (as of August 31, 1988), an analysis of the data by sex, minority group, and citizenship, and reports trends in the number of doctoral degrees for each of Groups I through V (see Appendix for description of groups). Table 0 provides the response rates for the 1988 Survey of New Doctorates.

TABLE 0: Response Rates

Group I	39 of 39
Group II	42 of 43 including 6 with 0 degrees
Group III	72 of 81 including 24 with 0 degrees
Group IV	50 of 69 including 3 with 0 degrees
Group Va	10 of 19 including 0 with 0 degrees
Group Vb	17 of 38 including 3 with 0 degrees
Group VI	19 of 28 including 5 with 0 degrees

Doctorates Granted

The number of new doctorates reported for 1987-1988 is 856 (fall 1988 count), compared to 845 for 1986-1987 (fall 1987 count). See Table 1A for comparable statistics from 1982-1983 on. These numbers are obtained from the Annual Survey Reports in the November *Notices*. The number of new doctorates awarded by U.S. institutions in 1987-1988 is 804 (fall count), compared to 779 in 1986-1987 (fall count). As is customary, a second, updated report on the 1987-1988 new doctorates is planned for a spring 1989 issue of *Notices*.

TABLE 1A: New Doctorates, Fall Counts

82-83	83-84	84-85	85-86	86-87	87-88
792	789	769	801	845	856

Table 1B contrasts the numbers reported in the fall and spring for the years 1982-1983 through 1987-1988.

TABLE 1B: New Doctorates, Fall and Spring Counts

	82-83	83-84	84-85	85-86	86-87	87-88
Fall	792	789	769	801	845	856
Spring	840	827	807	827	874	*

*To appear in a spring 1989 issue of *Notices*.

In Table 1C we record the number of new doctorates in the mathematical sciences in the U.S. and Canada from the years 1982-1983, exclusive of Group Vb. The response rate for Group Vb, which includes departments in engineering and management science, is the lowest of all groups.

TABLE 1C: New Doctorates Awarded by Groups I–Va, VI

82-83	83-84	84-85	85-86	86-87	87-88
767	735	755	743	809	787**

** This is a fall count. The other entries in Table 1C are spring counts. Table 1C will be updated to include a spring count for 1987-1988 in a spring 1989 issue of *Notices*.

Employment Status of New Doctorates, 1987-1988

Table 2A shows the employment status, by type of employer and field of degree, of the 856 recipients of doctoral degrees conferred by the mathematical sciences departments in the U.S. and Canada between July 1, 1987, and June 30, 1988. The names of these 856 individuals are listed with their thesis titles in a later section of this First Report of the 1988 Annual Survey. Again this year we present the employment status of the 153 women new doctorates in Table 2B.

The employment matrix, Table 2A, is similar to last year's, with a few exceptions. There was an increase in new doctorates hired in Groups I-V (207 compared to 188), and a decrease in new doctorates hired by government and business (96 compared to 110). Although women comprise 18% of the new doctorates (and 21% of the U.S. citizen doctorates), only 16% of the new hires in Groups I-V are women.

In rows 1 through 5 of Table 2A the numbers represent those who have accepted appointments in U.S. doctorate-granting mathematical sciences departments (Groups I-V). In the next two rows the figures represent those accepting appointments in U.S. mathematical sciences departments granting masters and bachelors as the highest degree. The information was initially obtained from the department granting the degrees and from data subsequently supplied by recipients themselves.

Of the 529 new doctorates employed in the U.S. 65% (345) assumed academic positions in university or four-year college mathematical sciences departments, and 21% (112) took employment in government, business, or industry. The former is a five percentage point rise over last year and the latter is unchanged.

Table 2A shows as "not yet employed" about 5% of the 1987-1988 new doctorates, excluding those whose employment status is unknown. The data in Table 2A were obtained in many instances early in the summer of 1988 and do not reflect subsequent hiring; an update of Table 2A is planned for the Second Report in a spring 1989 issue of *Notices*. A similar update last year revealed that all but 22 new 1986-1987 doctorates found positions by fall 1987 (see *Notices*, November 1987, page 1082, and April 1988, page 527).

Sex, Minority Group, and Citizenship of New Doctorates, 1987-1988

Table 3 presents a breakdown according to sex, minority group, and citizenship of these 856 new doctorates. The information reported in this table was obtained from departments granting the degrees and in some cases from the recipients themselves.

Of the 804 doctorates awarded by U.S. universities, the citizenship is reported as known for 798 recipients, with 363 reporting U.S. citizenship. Thus, only 45% of the doctorates awarded by U.S. institutions went to U.S. citizens. The percentage of U.S. citizens receiving doctorates in the mathematical sciences has declined consistently, from 73% in 1979-1980 to 45% in 1987-1988. For the second consecutive year the number of U.S. citizens receiving doctorates in mathematics is well below 400. Refer to Table 4 and the accompanying graphs.

Women comprise 21% of the U.S. citizens receiving doctorates in the mathematical sciences from U.S. universities in 1987-1988. Since 1972-1973 this percentage has doubled. It has held fairly constant at or above 20% for the last six years. Table 5 presents the data for the period 1973-1974 through 1987-1988.

TABLE 2A: Employment Status of 1987–1988 New Doctorates in the Mathematical Sciences

Type of Employer	PURE MATHEMATICS										
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Discrete Mathematics	Other	Total
Group I	11	15	21	3	2	1	0	2	11	1	6	73
Group II	9	10	7	1	2	2	1	1	5	0	2	40
Group III	8	6	3	1	0	9	0	0	20	2	1	50
Group IV	0	0	0	0	3	28	1	0	0	0	1	33
Group V	0	0	0	0	0	0	0	6	5	0	1	11
Masters	12	8	11	1	2	14	2	3	11	2	5	71
Bachelors	16	17	6	4	1	4	0	0	13	1	5	67
Two-year Colleges	1	1	0	0	0	1	0	0	1	1	1	6
Other Academic Departments	6	5	1	0	2	19	2	7	13	0	13	68
Research Institutes	3	1	0	0	0	5	0	1	3	0	3	16
Government	0	1	0	0	0	8	0	3	1	0	1	14
Business and Industry	2	4	4	0	2	27	2	14	17	0	8	80
Canada, Academic	6	12	4	2	2	6	1	1	2	1	3	40
Canada, Nonacademic	0	0	1	0	0	0	0	0	0	0	0	1
Foreign, Academic	19	17	13	7	3	29	4	12	14	1	9	128
Foreign, Nonacademic	2	2	3	0	0	2	1	4	3	0	3	20
Not seeking employment	0	3	0	1	0	1	1	0	0	0	0	6
Not yet employed	9	5	4	2	0	8	0	0	10	2	4	44
Unknown	15	21	10	2	3	9	1	6	16	0	5	88
Total	119	128	88	24	22	173	16	60	145	11	71	856

TABLE 2B: Employment Status of 1987–1988 New Doctorates in the Mathematical Sciences Females Only

Type of Employer	PURE MATHEMATICS										
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Discrete Mathematics	Other	Total
Group I	3	0	2	0	0	0	0	1	2	0	1	9
Group II	2	1	2	1	1	0	1	1	2	0	0	11
Group III	2	1	0	1	0	0	0	0	0	0	0	4
Group IV	0	0	0	0	1	7	0	0	0	0	1	9
Group V	0	0	0	0	0	0	0	0	0	0	0	0
Masters	2	0	1	0	1	1	1	0	2	2	3	13
Bachelors	4	5	0	0	0	1	0	0	2	1	0	13
Two-year Colleges	1	0	0	0	0	1	0	0	1	1	0	4
Other Academic Departments	1	0	0	0	0	4	0	2	0	0	4	11
Research Institutes	0	0	0	0	0	2	0	0	1	0	0	3
Government	0	1	0	0	0	1	0	1	0	0	0	3
Business and Industry	2	0	1	0	0	8	0	0	3	0	3	17
Canada, Academic	1	3	0	1	0	1	0	0	1	0	0	7
Canada, Nonacademic	0	0	0	0	0	0	0	0	0	0	0	0
Foreign, Academic	3	3	0	1	1	7	0	1	0	0	2	18
Foreign, Nonacademic	1	1	0	0	0	1	0	0	1	0	1	5
Not seeking employment	0	1	0	0	0	1	0	0	0	0	0	2
Not yet employed	2	0	0	0	0	2	0	0	2	0	0	6
Unknown	3	5	1	1	0	4	1	0	2	0	1	18
Total	27	21	7	5	4	41	3	6	19	4	16	153

TABLE 3: Sex, Minority Group, and Citizenship of New Doctorates
July 1, 1987–June 30, 1988

U.S. DEGREES	MEN					WOMEN					TOTAL
	CITIZENSHIP					CITIZENSHIP					
RACIAL/ETHNIC GROUP	U.S.	Canada	Other	Not Known	Total Men	U.S.	Canada	Other	Not Known	Total Women	
Asian, Pacific Islander	7	1	149	3	160	2		26		28	188
Black	3		5		8	1				1	9
American Indian, Eskimo, Aleut	1		1		2						2
Mexican American, Puerto Rican, or other Hispanic	4		19		23	1		2		3	26
None of those above	269	8	161	3	441	69	2	33		104	545
Unknown	3		24		27	3		4		7	34
Total Number	287	9	359	6	661	76	2	65		143	804

CANADIAN DEGREES	MEN					WOMEN					TOTAL
	CITIZENSHIP					CITIZENSHIP					
RACIAL/ETHNIC GROUP	U.S.	Canada	Other	Not Known	Total Men	U.S.	Canada	Other	Not Known	Total Women	
Asian, Pacific Islander	1	2	5		8			1		1	9
Black											
American Indian, Eskimo, Aleut											
Mexican American, Puerto Rican, or other Hispanic								1		1	2
None of those above	1	16	8	3	28		1	6		7	35
Unknown		4	2		6		1			1	7
Total Number	2	22	15	3	42		2	8		10	52

Citizenship and Sex of U.S. Doctorates, 1973 to 1988

Again this year, information is presented on the annual number of doctorates granted by U.S. universities to U.S. citizens (Table 4). This number is divided into male and female doctorates (Table 5). These data are presented for the period 1973 to 1988 using the Annual Survey Reports published each year in the November *Notices*. Thus Tables 4 and 5 are extensions of tables in last year's Report. In Table 4 the first column (headed Adjusted Total of Doctorates given by U.S. Universities) gives the number of doctorates granted between July 1 and June 30 of the indicated years *whose citizenship is known*. Column 2 gives the number who are U.S. citizens and column 3 the percentage that this represents. In Table 5 the number in column 2 of Table 4 is further divided into men and women. Note that in both tables *all years prior to* 1982-1983 include doctorates granted by computer science departments.

TABLE 4: U.S. Citizen Doctorates

	Adjusted Total of Doctorates given by U.S. universities	Total of Doctorates who are U.S. citizens	%
1973-1974	938	677	72%
1974-1975	999	741	74%
1975-1976	965	722	75%
1976-1977	901	689	76%
1977-1978	868	634	73%
1978-1979	806	596	74%
1979-1980	791	578	73%
1980-1981	839	567	68%
1981-1982	798	519	65%
1982-1983	744	455	61%
1983-1984	738	433	59%
1984-1985	726	396	55%
1985-1986	755	386	51%
1986-1987	739	362	49%
1987-1988	798	363	45%

Graph for Table 4: U.S. Citizen Doctorates
Total of Doctorates Who Are U.S. Citizens

Graph for Table 4: U.S. Citizen Doctorates
Total of Doctorates by Percent

TABLE 5: U.S. Citizen Doctorates, Male and Female

	Doctorates who are U.S. Citizens	Male	Female	% Female
1973-1974	677	618	59	9%
1974-1975	741	658	83	11%
1975-1976	722	636	86	12%
1976-1977	689	602	87	13%
1977-1978	634	545	89	14%
1978-1979	596	503	93	16%
1979-1980	578	491	87	15%
1980-1981	567	465	102	18%
1981-1982	519	431	88	17%
1982-1983	455	366	89	20%
1983-1984	433	346	87	20%
1984-1985	396	315	81	20%
1985-1986	386	304	82	21%
1986-1987	362	289	73	20%
1987-1988	363	287	76	21%

Concluding Remarks

We again express our deep concern at the low number of American citizens receiving doctorates in the mathematical sciences. Tables 4 and 5, and the accompanying graphs, provide cause for alarm within the mathematics community and the many groups it services. American business, industry, government and academe must be prepared for the severe effects of this drought.

We close with a quote from the National Research Council's *Summary Report 1986 - Doctorate Recipients from United States Universities*, which comments on the failure of mathematics to match the physical sciences in relative doctoral production:

"The growth evidenced in the 1980s [in the number of doctorates awarded in the physical sciences], however, disguised the fact that the cluster field of mathematics never stemmed the decline that began in the 1970s. The 730 mathematics doctorates earned in 1986 were 43 percent fewer than the 1,281 Ph.D.s earned in 1972. Note that the field of computer sciences was added in 1977, and it attracted some scholars who might otherwise have studied mathematics (or engineering). Yet even when the computer scientists were added to the mathematicians, the combined number in 1986 (1,129) still represented a loss that was double the average size of decline (12 percent, instead of 6 percent). Moreover, the field of mathematics decreased despite its attraction of the largest component of temporary visa-holders of any of the physical sciences - 37.3 percent."

Summary Report 1986 - Doctorate Recipients from United States Universities, National Academy Press, Washington, D.C. 1987, pages 21-22.

(For a detailed comparison with the physical sciences see *Taking Stock: Is American Mathematics in Decline?*, Edward A. Connors, *The Scientist*, to appear.)

Salary Survey for New Recipients of Doctorates, 1987-1988

The figures for 1988 were compiled from questionnaires sent to individuals who received a doctorate in the mathematical sciences during the 1987-1988 academic year from universities in the United States and Canada.

Questionnaires requesting information on salaries and professional experience were distributed to 669 recipients of degrees using addresses provided by the departments which granted the degrees. Of these, 9 were returned by the postal service as undeliverable and could not be forwarded. There were 347 individuals who returned forms between late June and early September. The tables below are based on the responses from 307 of these individuals (240 men and 67 women). Data from 40 responses were not used in the compilation of the tables below; forms with insufficient data, or from individuals who had indicated they had part-time employment, were not yet employed, or were not seeking employment were considered unusable.

Readers should be warned that the data in this report are obtained from a self-selected sample and inferences from them may not be representative of the population. For more comprehensive information on the recipients of new doctorates granted last year in the mathematical sciences in the U.S. and Canada, see the preceding article by E. Connors.

Key to Tables. *Salaries* are listed in hundreds of dollars. *Years* listed refer to the academic year ending in the listed year. *M* and *F* are Male and Female respectively. *One year experience* means that the persons had experience limited to one year or less in the same position or a position similar to the one reported; some persons receiving a doctorate had been employed in their present position for several years. $(X + Y)$ means there are *X men and Y women* in the 1988 sample. Quartile figures are given only in cases where the number of responses is large enough to make them meaningful.

Graphs. The horizontal line represents the median salary for 1987 in hundreds of dollars. The points plotted are the relevant data for each year converted to 1987 dollars using the implicit price deflator prepared annually by the Bureau of Economic Analysis, U.S. Department of Commerce. Where available, first and third quartiles appear as boxes along the vertical lines. (Because the deflator is not yet available for this year, the 1988 figures do not appear on the graphs.)

Note that salaries for teaching, or teaching and research, have yet to return to their high point of 1970, although steady progress has been made since 1980. (For further details, see Donald Rung's article, "A Fifteen Year Retrospective on Academic Salaries of U.S. Doctorate Holding Faculty," in the November 1985 issue of *Notices*, pp. 772-773.)

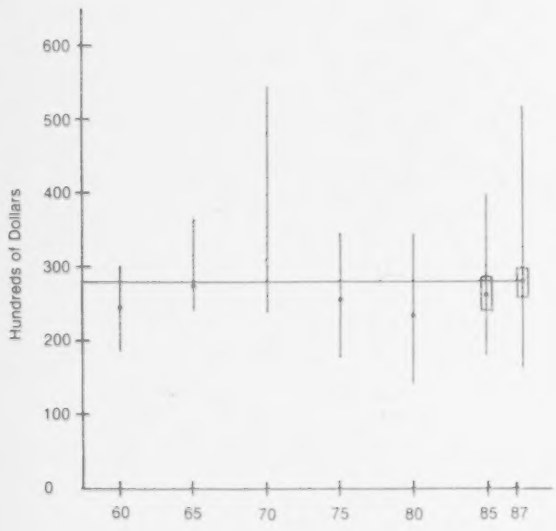
Nine-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1987 $
TEACHING OR TEACHING AND RESEARCH (148 + 42)						
1960	49		65		80	248
1965	70		80		105	279
1970	85		110		195	308
1975	90	120	128	135	173	254
1980	105	155	171	185	250	235
1983	80	200	217	240	350	246
1984	140	215	230	255	380	251
1985	170	23	250	270	380	264
1986	170	250	269	290	400	278
1987	165	260	280	300	517	280
1988	200	275	293	314	575	—
1985M	186	232	250	270	380	
1985F	170	215	242	270	366	
1986M	170	250	269	290	400	
1986F	230	250	268	294	270	
1987M	165	260	280	300	517	
1987F	230	251	280	325	420	
1988M	200	274	290	315	520	
1988F	216	275	299	314	575	
One Year Experience (122 + 32)						
1988M	200	273	290	312	450	
1988F	216	275	295	310	360	

Nine-Month Salaries

Year	Min	Median	Max	Reported Median in 1987 $
RESEARCH (6 + 0)				
1960	52	65	80	248
1965	71	81	90	282
1970	78	105	160	294
1975	100	—	110	—
1980	125	137	180	188
1983	100	200	230	227
1984	205	205	205	224
1985	205	235	250	249
1986	215	245	280	253
1987	250	300	300	300
1988	260	280	385	—
1985M	205	226	250	
1985F	—	—	—	
1986M	215	250	280	
1986F	240	240	240	
1987M	250	300	300	
1987F	—	—	—	
1988M	260	280	385	
1988F	—	—	—	
One Year Experience (5 + 0)				
1988M	260	260	385	
1988F	—	—	—	

Nine-Month Teaching



Nine-Month Research

Graph omitted because sample size too small

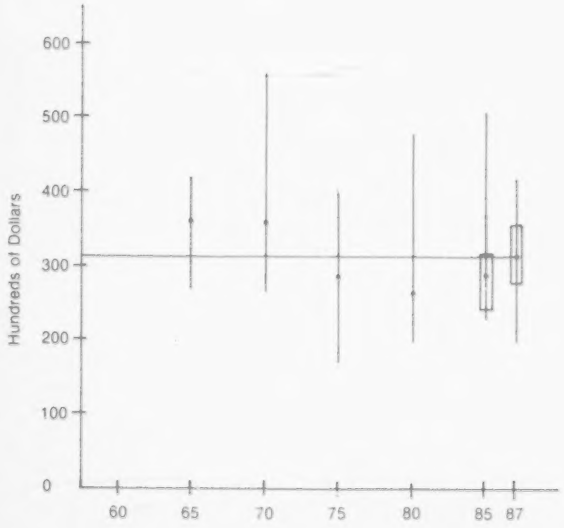
Twelve-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1987 $
TEACHING OR TEACHING AND RESEARCH (24 + 7)						
1960	.....		NO DATA		.....	
1965	78		104		121	362
1970	95		128		200	359
1975	87		145		204	288
1980	143		195		350	268
1983	160		260		320	295
1984	134		260		450	284
1985	220	230	273	300	470	290
1986	220	265	320	360	480	331
1987	200	283	315	357	520	315
1988	220	313	330	360	480	—
1985M	230	235	240	300	470	
1985F	220	243	280	295	420	
1986M	220	270	321	360	480	
1986F	240	245	285	340	360	
1987M	200	270	300	358	520	
1987F	300	320	339	357	450	
1988M	220	308	330	355	480	
1988F	329	335	350	365	441	
One Year Experience (20 + 4)						
1988M	220	303	325	350	400	
1988F	329	330	340	396	441	

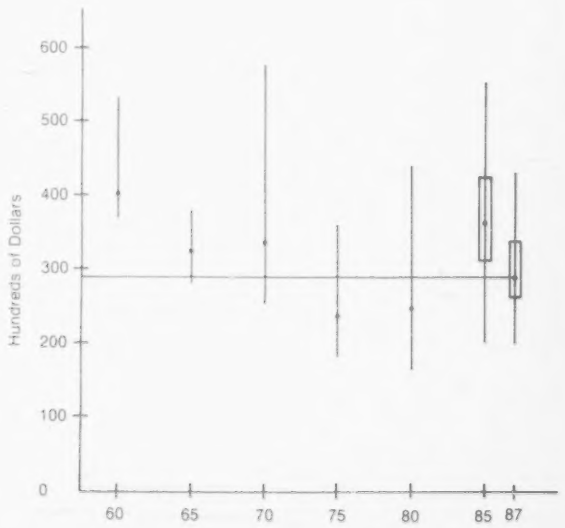
Twelve-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1987 $
RESEARCH (15 + 5)						
1960	97		105		140	400
1965	81		93		107	324
1970	90		120		205	336
1975	90		119		180	236
1980	120		180		321	247
1983	155		262		450	297
1984	145		261		415	285
1985	190	295	342	400	520	363
1986	160	240	300	325	510	310
1987	200	260	287	337	430	287
1988	200	245	295	331	505	—
1985M	190	300	360	405	520	
1985F	279	290	300	312	323	
1986M	160	240	300	330	510	
1986F	240	240	270	300	300	
1987M	200	250	282	337	400	
1987F	300	308	316	373	430	
1988M	200	240	280	330	505	
1988F	280	320	330	350	360	
One Year Experience (14 + 4)						
1988M	200	240	280	330	505	
1988F	320	325	340	355	360	

Twelve-Month Teaching



Twelve-Month Research



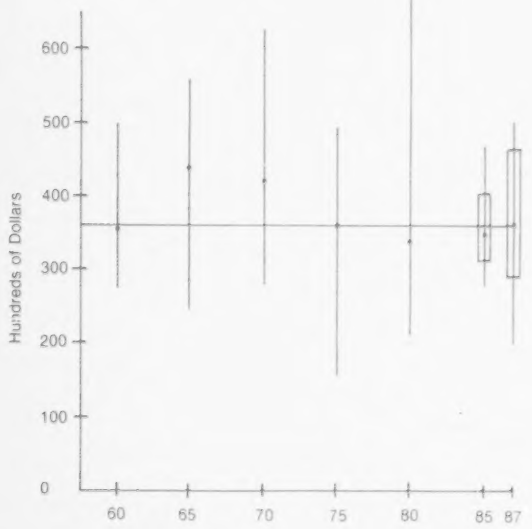
Twelve-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1987 $
			GOVERNMENT (9 + 2)			
1960	72		93		130	354
1965	70		126		160	438
1970	100		150		223	420
1975	78		182		247	361
1980	156		244		501	335
1983	160		322		422	365
1984	140		315		490	344
1985	263	294	325	381	440	345
1986	270	330	400	449	610	413
1987	200	290	360	465	500	360
1988	240	298	343	405	436	—
1985M	263	294	325	381	440	
1985F	—	—	—	—	—	
1986M	270	330	400	449	610	
1986F	—	—	—	—	—	
1987M	200	290	360	465	500	
1987F	—	—	—	—	—	
1988M	240	290	332	360	436	
1988F	380	380	405	430	430	
One Year Experience (7 + 2)						
1988M	240	285	305	338	435	
1988F	380	380	405	430	430	

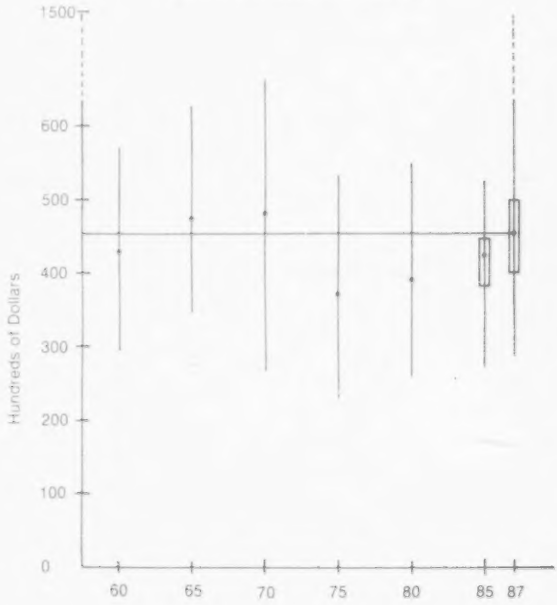
Twelve-Month Salaries

Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1987 $
			BUSINESS AND INDUSTRY (38 + 11)			
1960	78		110		150	419
1965	100		136		180	474
1970	96		170		235	476
1975	114		187		240	371
1980	190		284		400	390
1983	276		375		580	425
1984	180		378		660	413
1985	260	360	400	420	493	425
1986	324	373	425	477	750	439
1987	290	400	451	500	1500	451
1988	300	400	400	490	1100	—
1985M	260	360	400	425	493	
1985F	295	330	370	409	430	
1986M	324	390	453	492	750	
1986F	350	357	375	400	440	
1987M	290	400	465	517	1500	
1987F	300	394	424	466	502	
1988M	300	400	431	490	1100	
1988F	375	437	454	495	660	
One Year Experience (26 + 4)						
1988M	300	380	415	470	540	
1988F	418	426	437	470	500	

Twelve-Month Government



Twelve-Month Industry



Faculty Salaries, Tenure, Women

The questionnaires sent to departments in the mathematical sciences asked for information on salaries and tenure. Departments submitted a minimum, median, and maximum salary figure for each of four academic ranks, for staff members both with and without doctorates. Annual salaries of full-time faculty members for the academic year of 9 or 10 months were sought. The 1988 questionnaire requested information for both the years 1987-1988 and 1988-1989. In the salary tables on the following pages the numbers in parentheses give the range of the middle fifty percent of salaries reported. The figures outside the parentheses represent the minimum and maximum salary listed by any reporting institution. In some categories relatively few departments reported and, because significant figures were not available, salaries are not listed.

The information reported this year on the number of faculty members is based on returns from 729 departments in the mathematical sciences, 60 of which did not contain usable salary information.

TABLE 1: Total Faculty Reported for Four-Year Colleges and Universities

	1987–1988				1988–1989			
	Faculty		Women		Faculty		Women	
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure
WITHOUT DOCTORATE								
Instructor/Lecturer	850	45	482	17	810	51	476	20
Assistant Professor	624	313	193	85	603	302	193	81
Associate Professor	375	344	64	56	364	333	65	56
Professor	128	118	13	12	130	120	15	14
Total	1977	820	752	170	1907	806	749	171
WITH DOCTORATE								
Instructor/Lecturer	198	15	50	5	196	14	42	4
Assistant Professor	1913	192	314	28	2026	217	343	36
Associate Professor	2541	2205	241	207	2546	2233	264	222
Professor	4298	4223	217	200	4387	4299	231	213
Total	8950	6635	822	440	9155	6763	880	475

TABLE 2: Percent of Doctorate Faculty with Tenure

	Fall 1987	Fall 1988
Groups I, II, III	77.2%	76.8%
Groups IV, V	74.1%	73.7%
Group VI	88.5%	88.9%
Masters and Bachelors	69.5%	69.5%

TABLE 3: Response Rates

U.S. Departments

Group	I	II	III	IV	V	M	B
% Response	67	93	79	74	29	53	40

Canadian Departments

Group	VI
% Response	57

Response Rates. Response rates among the various classes of departments vary widely, thus making it difficult to draw firm conclusions about the sizes of the faculty groups studied. Because the questionnaires request data for two years in a row, however, it is possible to estimate relative changes from one year to the next with somewhat more confidence. This year's response rates are given in Table 3. As in past years, the greatest rates of response are in Groups I, II, and III, which have a combined response rate of 80%.

	SIZE OF FACULTY 1987–1988				SIZE OF FACULTY 1988–1989				SALARIES (in hundreds of dollars) 1987–1988			SALARIES (in hundreds of dollars) 1988–1989		
	FACULTY		WOMEN		FACULTY		WOMEN							
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure	Minimum	Median	Maximum	Minimum	Median	Maximum
DOCTORATE GRANTING DEPARTMENTS														
Group I (26 of 39 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	6	1	3	0	5	1	2	0						
Assistant Professor	0	0	0	0	0	0	0	0						
Associate Professor	0	0	0	0	0	0	0	0						
Professor	0	0	0	0	0	0	0	0						
	6	1	3	0	5	1	2	0						
WITH DOCTORATE														
Instructor/Lecturer	88	2	13	0	88	2	12	0	218(260-296)	(266-298)	(272-303)385	266(278-312)	(276-316)	(289-358)414
Assistant Professor	161	2	12	0	163	2	11	0	241(276-315)	(299-343)	(325-374)415	248(290-330)	(316-356)	(335-396)439
Associate Professor	186	176	12	12	194	185	14	14	279(302-397)	(370-434)	(400-485)575	293(322-393)	(389-455)	(432-521)615
Professor	754	753	18	18	765	764	20	20	312(347-450)	(515-629)	(737-908)1100	312(375-497)	(555-659)	(831-950)1190
	1189	933	55	30	1210	953	57	34						
DOCTORATE GRANTING DEPARTMENTS														
Group II (40 of 43 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	76	4	52	2	70	4	46	2	160(192-218)	(201-234)	(209-250)265	166(200-236)	(203-246)	(223-271)494
Assistant Professor	7	7	1	1	6	6	1	1	238(238-292)	—	—	—	—	—
Associate Professor	9	8	2	1	8	7	2	1	303(303-416)	—	—	—	—	—
Professor	3	3	0	0	3	3	0	0	427(427-534)	—	—	—	—	—
	95	22	55	4	87	20	49	4						
WITH DOCTORATE														
Instructor/Lecturer	31	2	9	0	35	2	6	0	203(208-284)	(208-293)	(216-364)381	212(231-297)	(214-310)	(242-378)382
Assistant Professor	242	20	32	2	252	29	35	1	230(264-310)	(288-338)	(312-375)457	255(283-327)	(306-360)	(340-403)493
Associate Professor	400	380	23	21	403	384	26	24	229(295-364)	(334-410)	(394-488)553	236(306-372)	(357-418)	(430-517)608
Professor	729	727	25	24	744	732	25	25	313(366-431)	(462-570)	(644-784)900	313(389-465)	(487-613)	(675-857)950
	1402	1129	89	47	1434	1147	92	50						
DOCTORATE GRANTING DEPARTMENTS														
Group III (64 of 81 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	109	0	60	0	96	1	64	1	136(163-195)	(173-221)	(183-237)390	136(167-200)	(187-229)	(190-245)390
Assistant Professor	32	28	13	10	27	23	11	7	216(222-296)	(235-309)	(249-318)450	220(237-340)	(245-344)	(259-344)420
Associate Professor	21	21	2	2	19	18	1	1	239(267-425)	(305-405)	(309-430)433	248(270-452)	(315-438)	(351-455)470
Professor	9	8	0	0	8	7	0	0	—	—	—	—	—	—
	171	57	75	12	150	49	76	9						
WITH DOCTORATE														
Instructor/Lecturer	18	1	5	0	12	1	4	0	—	—	—	—	—	—
Assistant Professor	364	28	44	3	394	23	48	2	207(253-285)	(279-309)	(301-348)460	240(266-300)	(288-328)	(316-353)460
Associate Professor	460	414	33	31	435	401	43	40	190(280-340)	(324-380)	(360-437)520	200(289-358)	(338-393)	(377-452)550
Professor	667	661	23	23	678	671	19	18	234(338-421)	(410-506)	(517-687)915	313(356-444)	(439-530)	(538-718)981
	1509	1104	105	57	1519	1096	114	60						
DOCTORATE GRANTING DEPARTMENTS														
Group IV (51 of 69 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	10	0	9	0	11	0	11	0						
Assistant Professor	3	1	0	0	5	1	1	0						
Associate Professor	6	4	0	0	6	4	0	0						
Professor	7	7	1	1	7	7	1	1						
	26	12	10	1	29	12	13	1						
WITH DOCTORATE														
Instructor/Lecturer	13	2	8	2	11	1	6	1	—	—	—	—	—	—
Assistant Professor	126	2	28	0	131	2	28	0	270(296-320)	(310-344)	(321-369)442	294(307-353)	(322-361)	(336-390)446
Associate Professor	150	117	15	10	154	120	17	11	269(327-392)	(365-417)	(376-490)591	307(340-417)	(382-442)	(414-513)655
Professor	363	350	20	11	365	354	20	11	348(403-492)	(493-631)	(622-838)1022	323(433-517)	(524-664)	(650-893)1200
	652	471	71	23	662	477	71	23						

	SIZE OF FACULTY 1987–1988				1988–1989				SALARIES (in hundreds of dollars) 1987–1988			1988–1989		
	FACULTY		WOMEN		FACULTY		WOMEN							
	Total	With Tenure	Total	With Tenure	Total	With Tenure	Total	With Tenure	Minimum	Median	Maximum	Minimum	Median	Maximum
DOCTORATE GRANTING DEPARTMENTS														
Group V (9 of 31 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	0	0	0	0	0	0	0	0						
Assistant Professor	0	0	0	0	0	0	0	0						
Associate Professor	0	0	0	0	0	0	0	0						
Professor	1	1	0	0	1	1	0	0						
	1	1	0	0	1	1	0	0						
WITH DOCTORATE														
Instructor/Lecturer	1	0	1	0	1	0	1	0	—	—	—	—	—	—
Assistant Professor	20	1	1	0	20	1	1	0	290(320–378)	(318–378)	(334–406)450	305(355–393)	(363–403)	(370–431)458
Associate Professor	20	19	0	0	19	17	0	0	302(344–423)	(372–479)	(402–533)580	400(405–436)	(413–501)	(419–553)590
Professor	86	86	5	5	87	87	5	5	417(430–539)	(542–638)	(735–860)880	440(460–580)	(610–676)	(770–868)920
	127	106	7	5	127	105	7	5						
DOCTORATE GRANTING DEPARTMENTS														
Group VI (16 of 28 reporting)														
(Canadian Departments)														
WITHOUT DOCTORATE														
Instructor/Lecturer	3	1	1	1	2	1	1	1						
Assistant Professor	18	9	6	4	15	9	6	4						
Associate Professor	10	10	1	1	10	10	1	1						
Professor	7	7	0	0	8	8	0	0						
	38	27	8	6	35	28	8	6						
WITH DOCTORATE														
Instructor/Lecturer	2	0	1	0	1	0	1	0	—	—	—	—	—	—
Assistant Professor	34	4	2	0	36	4	2	0	253(266–315)	(291–327)	(306–426)445	253(266–358)	(303–373)	(316–405)420
Associate Professor	124	118	7	7	122	119	8	8	294(329–476)	(406–509)	(451–544)677	318(366–483)	(428–559)	(451–667)718
Professor	172	172	4	4	177	176	4	4	397(414–526)	(499–673)	(561–790)926	391(412–583)	(499–707)	(561–983)997
	332	294	14	11	336	299	15	12						
MASTER DEGREE GRANTING DEPARTMENTS														
(143 of 271 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	332	26	201	11	330	27	199	12	124(176–223)	(188–235)	(205–284)554	124(181–235)	(194–263)	(211–303)580
Assistant Professor	201	134	60	32	200	133	58	30	195(254–305)	(273–333)	(286–352)428	204(265–322)	(286–337)	(296–371)450
Associate Professor	132	128	19	18	130	125	20	18	205(288–380)	(310–392)	(333–412)527	240(300–395)	(323–414)	(350–415)575
Professor	47	46	4	3	48	46	5	4	340(392–510)	(411–530)	(425–530)590	354(405–517)	(424–530)	(449–534)629
	712	334	284	64	708	331	282	64						
WITH DOCTORATE														
Instructor/Lecturer	30	7	8	3	29	7	7	3	197(207–315)	(261–336)	(274–371)431	201(227–332)	(300–354)	(257–385)439
Assistant Professor	517	74	99	14	545	87	109	20	200(255–287)	(269–311)	(292–351)463	210(268–302)	(287–329)	(308–370)508
Associate Professor	643	527	79	65	656	546	88	69	132(292–347)	(324–388)	(354–436)533	132(308–357)	(339–402)	(380–462)558
Professor	881	852	55	52	893	869	63	59	263(355–430)	(387–480)	(420–536)840	257(373–446)	(409–499)	(442–568)905
	2071	1460	241	134	2123	1509	267	151						
BACHELOR DEGREE GRANTING DEPARTMENTS														
(380 of 952 reporting)														
WITHOUT DOCTORATE														
Instructor/Lecturer	314	13	156	3	296	17	153	4	135(193–224)	(200–237)	(207–248)336	144(201–244)	(206–250)	(219–265)355
Assistant Professor	363	134	113	38	350	130	116	39	140(215–273)	(231–285)	(244–309)399	170(225–285)	(240–305)	(261–326)419
Associate Professor	197	173	40	34	191	169	41	35	180(253–352)	(270–358)	(278–382)507	180(269–368)	(285–388)	(291–412)553
Professor	54	46	8	8	55	48	9	9	280(319–409)	(339–432)	(317–457)527	211(330–416)	(331–448)	(330–450)559
	928	366	317	83	892	364	319	87						
WITH DOCTORATE														
Instructor/Lecturer	15	1	5	0	18	1	5	0	188(202–278)	(215–285)	(202–295)304	200(211–301)	(221–300)	(211–316)319
Assistant Professor	449	61	96	9	485	69	109	13	190(246–280)	(257–290)	(266–321)493	198(260–298)	(285–310)	(286–342)480
Associate Professor	558	454	72	61	563	461	68	56	180(279–330)	(292–351)	(309–385)687	180(295–357)	(305–375)	(324–410)736
Professor	646	622	67	63	678	646	75	71	224(325–400)	(331–440)	(360–479)765	232(346–430)	(352–473)	(377–506)796
	1668	1138	240	133	1744	1177	257	140						

ACKNOWLEDGEMENT

The Annual AMS-MAA Survey attempts to provide an accurate appraisal and analysis of various aspects of the mathematical scene vital to the entire mathematical community. Yearly, collegiate departments in the United States, and the doctoral-granting departments in Canada, are provided the opportunity to respond to this survey. The quantity and quality of the responses directly determine the quality of the information in these reports. Without the dedicated cooperation of the secretarial and administrative support staff in the mathematical science departments we would not be able to conduct a survey, nor be confident in our analysis of its results. We are, unfortunately, unable to thank all the departmental assistants for their cooperation, but it is nonetheless appreciated. However, we are able to thank the administrative support staff of the AMS, especially Marcia Almeida, Monica Foulkes, James W. Maxwell, and James A. Voytuk. Their efforts are acknowledged and appreciated.

Groups I and **II** include the leading departments of mathematics in the U.S. according to the 1982 assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils in which departments were rated according to the quality of their graduate faculty.[1]
Group I is composed of 39 departments with scores in the 3.0–5.0 range.
Group II is composed of 43 departments with scores in the 2.0–2.9 range.
Group III contains the remaining U.S. departments reporting a doctoral program.
Group IV contains U.S. departments (or programs) of statistics, biostatistics and biometrics reporting a doctoral program.
Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research and management science which report a doctoral program.
Group Va is applied mathematics/applied science; **Group Vb** is operations research and management science.
Group VI contains doctorate-granting departments (or programs) in the mathematical sciences in Canadian universities.
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[1] These findings were published in *An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences*, edited by Lyle V. Jones, Gardner Lindzey, and Porter E. Coggeshall, National Academy Press, Washington, D.C., 1982. The information on mathematics, statistics and computer science was presented in digest form in the April 1983 issue of *Notices*, pages 257–267, and an analysis of the above classifications was given in the June 1983 *Notices*, pages 392–393. For a listing of departments in Groups I and II see April 1988 *Notices*, pages 532-533.

BIBLIOGRAPHY

[1] *Nurturing Science and Engineering Talent: A Discussion Paper*, July 1987. The Government-University-Industry Research Roundtable, NAS, Washington, DC.

[2] *Undergraduate Science, Mathematics and Engineering Education*, NSB 86-100, March 1986. NSB Task Committee on Undergraduate Science and Engineering Education.

[3] *The Future Workforce Conference Proceedings*, September 10-11, 1986, Goddard Space Flight Center, Greenbelt, Maryland, NASA Office of Educational Affairs and NASA Office of Productivity Programs.

[4] *Science and Technology Data Book*, NSF 87-317, Washington, DC, 1986.

[5] *Scientific Manpower–1987 and Beyond. Today's Budgets–Tomorrow's Workforce.* Proceedings of a Symposium, October 15, 1986, Washington, DC, sponsored by the Commission on Professionals in Science and Technology.

[6] *Foreign Citizens in U.S. Science and Engineering: History, Status and Outlook*, NSF 86-305 Revised, (Washington, DC, 1987).

[7] Linda Darling-Hammond, *Beyond the Commission Reports: The Coming Crisis in Teaching*, Rand Publication Series, R-3177-RC, July 1984.

[8] *Teaching Assistants and Part-time Instructors: A Challenge*, MAA Notes, 1987.

[9] *Scientific and Technical Personnel in the 1990's: An Examination of Issues and Information Needs.* Proceedings of the May 9-10, 1985 Conference, Washington, DC (Prepared for the Scientific and Technical Personnel Studies Section, Division of Science Resources Studies, NSF, by the Council of Professional Associations on Federal Statistics, Katherine K. Wallmann, Executive Director).

[10] D. J. Albers, R. D. Anderson, and D. O. Loftsgaarden, *Undergraduate Programs in the Mathematical and Computer Sciences. The 1985-1986 Survey*, MAA Notes, 7.

[11] *The Science and Engineering Pipeline*, Policy Research Analysis Report NSF PRA 87-2, April 1987.

[12] *The Underachieving Curriculum: Assessing U.S. School Mathematics from an International Perspective*, Stipes Publishing Co., Champaign, Illinois, January 1987.

[13] *Competition for Human Resources in the 1990s*, Proceedings of a Symposium, Commission on Professionals in Science and Technology, May 1988.

[14] *Science and Engineering Doctorates: 1960-86*, NSF 88-309, Washington, DC 1988.

[15] *Educating Scientists and Engineers: Grade School to Grad School*, U.S. Congress, Office of Technology Assessment, OTA-SET-377, Washington, DC, June 1988.

[16] *Boon or Bane – Foreign Graduate Students in U.S. Engineering Programs*, Institute of International Education Research Report Series, Number 15, 1988.

[17] *Summary Report 1986, Doctorate Recipients from United States Universities*, National Academy Press, Washington, DC, 1987.

[18] Edward A. Connors, *Taking Stock: Is American Mathematics in Decline?*, *The Scientist*, to appear.

6/89

NOTICES
OF THE
AMERICAN MATHEMATICAL SOCIETY

1988 ANNUAL AMS–MAA SURVEY

(Second Report)

Vital Statistics in the Mathematical Sciences:
Distribution of Undergraduate Enrollments, Faculty Characteristics,
Update on New Doctorates, Fall 1988

Edward A. Connors

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HIGHLIGHTS

1. *The final (spring) count of new doctorates in the mathematical sciences records 372 U.S. citizens among the 828 recipients of doctorates granted by U.S. institutions from July 1, 1987 through June 30, 1988. Thus the sum total of U.S. citizens receiving doctorates in the last two years is less than a single year total in the mid-1970's.*
2. *Respondents from Groups B, M and III (see box on this page for descriptions of the groupings used in this Survey) report that approximately 1-3/4% of their fall 1987 full-time faculty retired permanently or died by fall 1988. The comparable number for Groups I, II and III combined is slightly more than 1-1/2%.*
3. *Group I respondents (33 of 39 departments) report that 64% of the fall 1987 undergraduate enrollments are distributed as follows: 9% in remedial mathematics (arithmetic, high school algebra, and geometry); 17% in traditional pre-calculus; 38% in first-year calculus.*
4. *Women comprise 47% of the U.S. citizen graduate students in Group IV (statistics, biostatistics and biometrics). However, U.S. citizens comprise only 49% of all the graduate students in Group IV.*
5. *Women comprise 47% of the junior/senior mathematics majors in Group B in fall 1987, and 44% of those in Group M. In Groups I, II and III combined, women comprise 40% of the junior/senior mathematics majors.*

A first report of the 1988 Survey appeared in the November 1988 *Notices*, pages 1301–1332. It included a report on the 1987–1988 new doctorates, starting salaries, faculty salaries, and a list of the names and thesis titles of the 1987–1988 doctorates. A supplementary list of 1987–1988 doctorates appeared in the April 1989 *Notices*.

The 1988 Annual AMS-MAA Survey represents the thirty-second in an annual series begun in 1957 by the Society. The 1988 Survey was under the direction of the AMS-MAA Committee on Employment and Educational Policy (CEEP), whose members were: Morton Brown, Stefan A. Burr, Edward A. Connors (chair), Philip C. Curtis, Jr., David J. Lutzer, Donald C. Rung and James S. Tattersall. The questionnaires were devised by CEEP's Data Subcommittee whose members were: Edward A. Connors (chair), Lincoln K. Durst (consultant), John D. Fulton, James F. Hurley, Charlotte Lin, Don O. Loftsgaarden, David J. Lutzer, James W. Maxwell (ex officio), Donald E. McClure, and Donald C. Rung. Comments or suggestions regarding this Survey may be directed to the subcommittee.

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I. INTRODUCTION

We report on several items of general and specific interest to the mathematical community, based on our analysis of the data compiled in the 1988 Annual AMS-MAA Survey. We begin with an update on the size and employment status of the 1987–1988 class of new doctorates, and then we direct our attention to the information provided by the departmental responses to the surveys on Faculty Mobility and Enrollments and Departmental Size.

In contrast to prior years' reports, we chose not to extrapolate from the raw data. Thus, for example, we do not provide estimates of various faculty populations or course enrollments, as was done in past survey reports. Instead, we focus on faculty retirement and death rates (Table 3A), enrollment distribution patterns (Table 4), faculty composition by sex (Tables 3B and 3C), and percentages of women among our junior/senior level mathematics majors and graduate students (Tables 5 and 7). Some of the data on the male/female distribution among mathematics faculty and students appear in this Survey for the first time. We leave it to the 1990 Conference Board on Mathematical Sciences (CBMS) Survey to provide the next best estimates on various faculty populations and student enrollments.

Table 0: Useable Responses
(Percentage of Surveyed Departments)

	Groups							
	I	II	III	IV	V	VI	M	B
Enrollments and Departmental Size*	79	84	73	68	35	68	44	38
Faculty Mobility	69	65	70	59	35	64	43	35

*There are 4 parts to the Enrollments and Departmental Size form (Enrollments, Majors, Departmental Size, and Graduate Students). The number given is the number of returns with a useable response on the departmental size.

II. UPDATE ON THE 1987–1988 NEW DOCTORATES

In the First Report of this Survey (November 1988 issue of *Notices*, pages 1301–1332) we reported 804 new doctorates in the mathematical sciences granted by U.S. universities—this is the fall count. There were an additional 24 new doctorates from U.S. universities with a Group I, II, III, IV or Va classification. We now update tables from the First Report (New Doctorates, Fall and Spring Counts, and New Doctorates awarded by Groups I–Va, VI, see November 1988 *Notices*, page 1302) with this new information to produce the 1987–1988 spring counts: 828 new doctorates awarded by U.S. universities, 55 by Canadian universities, for a total of 883 (U.S. and Canada). Of the 828 new doctorates awarded by U.S. universities, 372 went to U.S. citizens (citizenship is known for 816 of the 828 new doctorates). Of the 372 U.S. citizen new doctorates, 294 were men, 78 women. The spring count for Canadian institutions is: 55 new doctorates–45 men, 10 women. Tables 1A, 1B and 1C give spring counts of new doctorates.

Table 1A: New Doctorates
U.S. and Canadian Institutions,
Fall and Spring Counts

	1982-1983	1983-1984	1984-1985	1985-1986	1986-1987	1987-1988
Fall	792	789	769	801	845	856
Spring	840	827	807	827	874	883

Table 1B: New Doctorates
U.S. Institutions, Spring Count

1982-1983	1983-1984	1984-1985	1985-1986	1986-1987	1987-1988
796	775	765	782	808	828

Table 1C: New Doctorates
Awarded by Groups I-Va, VI, Spring Count

1982-1983	1983-1984	1984-1985	1985-1986	1986-1987	1987-1988
767	735	755	743	809	815

Employment data for new doctorates are updated in Tables 2A, 2B and 2C. We do not, however, include the additional new doctorates in our updated employment matrices.

For the fourth consecutive year approximately 20% of the new doctorates reported taking foreign academic or nonacademic employment (Table 2A).

Women comprise 18% of the new doctorates. 23% of the 153 new women doctorates found employment in the doctorate-granting institutions, Groups I–V. Although only 15.5% of the new doctorates hired by the doctorate-granting institutions I–V were women, this is 3 percentage points better than last year. Women accounted for 18% of the new doctorates hired by Group M, and 20% of the new doctorates hired by Group B.

Table 2A: Employment Status of 1987–1988 New Doctorates in the Mathematical Sciences

Type of Employer	PURE MATHEMATICS											
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Discrete Mathematics	Other	Total
Group I	15	18	25	3	3	3		2	11	1	6	87
Group II	10	10	8	1	3	2	1	1	5		1	42
Group III	11	6	3	1		8			21	2	1	53
Group IV		1			3	28	1				1	34
Group V								5	5		1	11
Masters	13	9	11	1	2	14	2	3	14	2	6	77
Bachelors	17	17	7	4	1	4			15	1	5	71
Two-year College or High School	1	2				1			1	1	1	7
Other Academic Departments	6	6	1	2	2	21	2	7	15		16	78
Research Institutes	3	2	1			5		1	3		3	18
Government		1				8		3	1		2	15
Business and Industry	3	5	4		2	32	3	14	21	1	10	95
Canada, Academic	6	14	4	2	2	6	1	1	4	1	3	44
Canada, Nonacademic			1			1						2
Foreign, Academic	25	24	15	8	3	34	4	16	17	1	10	157
Foreign, Nonacademic	2	2	3			2	1	4	3		3	20
Not seeking employment		3		1		1	1					6
Not yet employed	2		2	1		1			3	1	1	11
Unknown	5	8	3		1	2		2	6		1	28
Total	119	128	88	24	22	173	16	59	145	11	71	856

Table 2B: Employment Status of 1987-1988 New Doctorates in the Mathematical Sciences Females Only

Type of Employer	PURE MATHEMATICS											
	Algebra and Number Theory	Analysis and Functional Analysis	Geometry and Topology	Logic	Probability	Statistics	Computer Science	Operations Research	Applied Mathematics	Discrete Mathematics	Other	Total
Group I	5		2					1	2		1	11
Group II	2	1	2	1	1		1	1	2			11
Group III	2	1		1								4
Group IV					1	7					1	9
Group V												
Masters	2		1		1	1	1		3	2	3	14
Bachelors	5	5				1			2	1		14
Two-year College or High School	1	1				1			1	1		5
Other Academic Departments	1			1		4		2			5	13
Research Institutes						2			1			3
Government		1				1		1				3
Business and Industry	2	1	1			9	1		4		3	21
Canada, Academic	1	3		1		1			1			7
Canada, Nonacademic						1						1
Foreign, Academic	4	4		1	1	10		1	1		2	24
Foreign, Nonacademic	1	1				1			1		1	5
Not seeking employment		1				1						2
Not yet employed									1			1
Unknown	1	2	1			1						5
Total	27	21	7	5	4	41	3	6	19	4	16	153

Table 2C: Fields of New Doctorates

	Year Surveyed					
	1982–1983	1983–1984	1984–1985	1985–1986	1986–1987	1987–1988
Number (Fall Count)	792	789	769	801	845	856
Specialty:						
Applied Math	103 (13%)	110 (14%)	115 (15%)	149 (19%)	142 (17%)	142 (17%)
Statistics	188 (24%)	173 (22%)	189 (25%)	171 (21%)	182 (22%)	173 (20%)
Operations Research	63 (8%)	66 (8%)	41 (5%)	62 (8%)	51 (6%)	59 (7%)
Computer Science	18 (2%)	20 (3%)	15 (2%)	16 (2%)	18 (2%)	16 (2%)
Total	372 (47%)	369 (47%)	360 (47%)	398 (50%)	393 (47%)	393 (46%)

The research fields of the new doctorates continue to have an applied flavor (see Table 2C). For the last five years half, or nearly half, of the new doctorates specialized in statistics, applied mathematics, operations research, or computer science. In fact, in each of the years in question between one-fifth and one-fourth of the degrees were in statistics.

Groups I–IV hired 214 new doctorates (23 more than last year) and Group M hired 77 (8 more than last year). The totals of new doctorates hired by business, industry or government, or appointed by research institutes, were down considerably.

Finally, we note that the names of the 1987–1988 new doctorates and their thesis titles were published in the *Notices* (November 1988 issue and a supplemental list in the April 1989 issue).

III. FACULTY CHARACTERISTICS

In Table 3A we provide the attrition rates of full-time faculty and full-time doctoral faculty by groups. The numbers we report are obtained from the departmental response to our request for the numbers of full-time faculty (doctorate and non-doctorate) in fall 1987 who had permanently retired or died by fall 1988. The 1989 AMS-MAA Survey will attempt to ascertain more information on age distribution of full-time faculty and thus better analyze the greying of the contemporary mathematical sciences faculty.

Table 3A: Faculty Attrition*

Group	Full-time Faculty	Full-time Doctoral Faculty
	%	%
I	1.26	1.27
II	1.65	1.69
III	1.76	1.62
I+II+III	1.57	1.52
IV	.99	1.03
V	.88	.9
B	1.72	1.52
M	1.73	1.19
B + M	1.72	1.34

*Percentage of full-time faculty who were in the department in fall 1987 but were reported to have retired (and not seeking employment) or died by fall 1988.

In Table 3B we provide percentages of women among the full-time doctoral faculty in Groups I–V, M and B and in Table 3C we give the percentages of women among full-time faculty in Groups M and B.

Table 3B: Percentage of Women among Doctoral Full-time Faculty

Groups							
I	II	III	I+II+III	IV	V	B	M
4.4%	6.5%	7.7%	6.2%	10.8%	3.4%	16.3%	12.7%

Table 3C: Percentage of Women among Full-time Faculty, Groups B and M

Group B	Group M
24%	20%

IV. UNDERGRADUATE ENROLLMENT PROFILE AND MAJORS

In Table 4A we give the percentage change from fall 1987 to fall 1988 in undergraduate enrollment in mathematical sciences.

In Table 4B we provide the undergraduate enrollment distributions in remedial mathematics (defined on our survey forms as arithmetic, high school algebra or geometry), traditional pre-calculus, and first-year calculus. We do not distinguish between hard core and soft core first-year calculus. It is somewhat startling, but by no means novel, that approximately 65% of the undergraduate enrollments in Groups I and II are in these three course groupings and, indeed, that 10% or nearly 10% is in remedial mathematics courses. Yet the 10% rate is only slightly more than half the comparable rate for the Group B respondents. As we wrote in last year's report, "remedial mathematics and 'pre-calculus' continue to consume a considerable chunk of collegiate mathematics education." Given the current state of K–12 mathematics, what will be the size of the chunk when this year's kindergarteners enter college at the dawn of the 21st century?

Table 4A: Percentage Change from fall 1987 to fall 1988 in Undergraduate Enrollments

Groups				
I	II	III	B	M
-3%	0%	+2%	+3%	+3%

Table 4B: Undergraduate Enrollments Distribution

Group	Remedial Math. (arith., h.s. alg., geometry) %	Remedial Math. + pre-calculus %	Remedial Math. +pre-calculus +1st-yr. calculus %
I	9	26	64
II	10	36	65
III	16	39	62
I+II+III	12	35	64
B	19	36	51
M	17	34	50
M+B	18	35	50

It is often thought, and sometimes expressed, that one of the reasons for the sizes of the cohort of women among the new doctorates in the mathematical sciences (roughly 20% among U.S. citizens for the past six years) is a correspondingly low rate among undergraduate mathematics majors. This misconception persists perhaps because the data are not so widely publicized as the doctoral data. In Table 5 we provide the percentages of women among junior/senior mathematics majors. Note that these percentages are 47% and 44% in Groups B and M respectively.

Table 5: Percentage of Women among Junior/Senior Majors (including double majors)

Groups							
I	II	III	I+II+III	IV	V	B	M
36%	39%	42%	40%	43%	34%	47%	44%

V. GRADUATE ENROLLMENTS IN THE MATHEMATICAL SCIENCES, SEX AND CITIZENSHIP

Table 6 provides the percentage change in enrollments in graduate courses in the mathematical sciences, from fall 1987 to fall 1988. In Table 7 we provide the percentage of women among the U.S. citizens in the graduate populations. Table 8 gives fall 1988 data on U.S. citizens in the graduate cohort.

Table 6: Graduate Enrollments
Percentage change fall 1987 to fall 1988

	Groups				
	I	II	III	I+II+III	IV
	%	%	%	%	%
First year, full-time	-8	-6	-1.2	-6	+2
All years, full-time	+5	-1	+4	+3	+6

Table 7: Percentage of U.S. citizen women among U.S. citizen graduate students

	Groups						
	I	II	III	I+II+III	IV	V	M
	%	%	%	%	%	%	%
First year, full time	27	30	42	33	48	40	40
All years, full-time	24	29	38	29	47	20	40

Table 8: Citizenship of Graduate Students (Percentage of U.S. Citizens among Graduate Students whose citizenship is reported as known) Fall 1988

	Groups				
	I	II	III	IV	M
	%	%	%	%	%
First year, full time	59	60	63	53	81
All years, full-time	54	53	61	49	74

Data drawn from the 1988 Survey on Faculty Salaries, Tenure and Women, show the following picture of the composition of doctoral faculty in the mathematical sciences. These data are based on responses slightly different from those responses providing the data presented in Tables 3B and 3C.

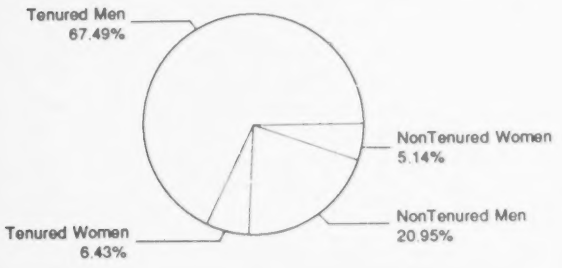

Fig. 1: Composition of Professorial Ranks with Ph.D., 1988-1989 (All Groups)

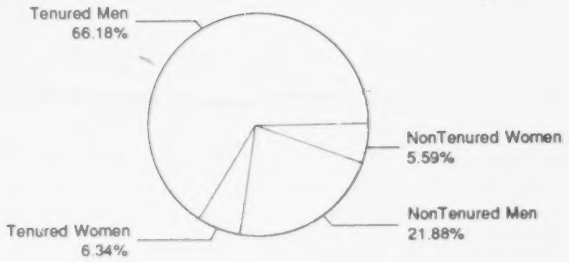

Fig. 2: Composition of faculty with Ph.D., 1988-1989 (All Ranks, All Groups)

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The Annual AMS-MAA Survey attempts to provide an accurate appraisal and analysis of various aspects of the academic mathematical scene vital to the entire mathematical community. Yearly, collegiate departments in the United States, and the doctorate-granting departments in Canada, are provided the opportunity to respond. The quantity and quality of the responses directly determine the quality of the information in these reports. Without the dedicated cooperation of the secretarial and administrative support staff in the mathematical science departments we would not be able to conduct a survey, nor be confident in our analysis of its results. We are, unfortunately, unable to thank personally all the departmental assistants for their cooperation, but it is nonetheless appreciated. However, we are able to thank the administrative support staff of the AMS, especially Marcia Almeida, Monica Foulkes, and James W. Maxwell, whose efforts are acknowledged and appreciated.

BIBLIOGRAPHY

[1] *Nurturing Science and Engineering Talent: A Discussion Paper*, July 1987. The Government-University-Industry Research Roundtable, NAS, Washington, DC.

[2] *Undergraduate Science, Mathematics and Engineering Education*, NSB 86-100, March 1986. NSB Task Committee on Undergraduate Science and Engineering Education.

[3] *The Future Workforce Conference Proceedings*, September 10-11, 1986, Goddard Space Flight Center, Greenbelt, Maryland, NASA Office of Educational Affairs and NASA Office of Productivity Programs.

[4] National Science Foundation. *Science and Technology Data Book*, (NSF 88-332). National Science Foundation, Washington, DC, 1989.

[5] *Scientific Manpower–1987 and Beyond. Today's Budgets–Tomorrow's Workforce.* Proceedings of a Symposium, October 15, 1986, Washington, DC, sponsored by the Commission on Professionals in Science and Technology.

[6] *Foreign Citizens in U.S. Science and Engineering: History, Status and Outlook*, NSF 86-305 Revised, (Washington, DC, 1987).

[7] Rand Publication Series. Reports on teaching and education: *Beyond the Commission Reports: The Coming Crisis in Teaching.* R-3177-RC, July 1984. *Steady Work: Policy, practice and the reform of American education.* R-3574-NIE/RC, February 1988. *The Evolution of Teacher Policy.* JRE-01, March 1988. *Assessing Teacher Sypply and Demand.* R-3633-ED/CSTP, May 1988.

[8] *Teaching Assistants and Part-time Instructors: A Challenge*, MAA Notes, 1987.

[9] *Scientific and Technical Personnel in the 1990's: An Examination of Issues and Information Needs.* Proceedings of the May 9-10, 1985 Conference, Washington, DC (Prepared for the Scientific and Technical Personnel Studies Section, Division of Science Resources Studies, NSF, by the Council of Professional Associations on Federal Statistics, Katherine K. Wallmann, Executive Director).

[10] D. J. Albers, R. D. Anderson, and D. O. Loftsgaarden, *Undergraduate Programs in the Mathematical and Computer Sciences. The 1985-1986 Survey*, MAA Notes, 7.

[11] *The Science and Engineering Pipeline*, Policy Research Analysis Report NSF PRA 87-2, April 1987.

[12] *The Underachieving Curriculum: Assessing U.S. School Mathematics from an International Perspective*, Stipes Publishing Co., Champaign, Illinois, January 1987.

[13] *Competition for Human Resources in the 1990s*, Proceedings of a Symposium, Commission on Professionals in Science and Technology, May 1988.

[14] *Science and Engineering Doctorates: 1960-86*, NSF 88-309, Washington, DC 1988.

[15] *Educating Scientists and Engineers: Grade School to Grad School*, U.S. Congress, Office of Technology Assessment, OTA-SET-377, Washington, DC, June 1988.

[16] *Boon or Bane – Foreign Graduate Students in U.S. Engineering Programs*, Institute of International Education Research Report Series, Number 15, 1988.

[17] National Research Council. *Summary Report 1986, Doctorate Recipients from United States Universities*, National Academy Press, Washington, DC, 1987.

[18] Edward A. Connors, *A Decline in Mathematics Threatens Science–and the U.S.*, The Scientist, November 28, 1988.

[19] Edward A. Connors, *America's Scientific Future is Threatened by the Decline in Mathematical Education*, The Chronicle of Higher Education, January 11, 1989.

[20] National Research Council. *Everybody Counts: A Report to the Nation on the Future of Mathematics Education.* National Academy Press, Washington, D.C., 1989.

[21] *Elementary and Secondary Education for Science and Engineering.* U.S. Congress, Office of Technology Assessment, OTA-TM-SET-41. Washington, D.C., December 1988.

[22] *Higher Education for Science and Engineering: a background paper.* U.S. Congress, Office of Technology Assessment, OTA-BP-SET-52. Washington, D.C., March 1989.

[23] *Changing America: The New Face of Science and Engineering.* Interim Report, Task Force on Women, Minorities, and the Handicapped in Science. September 1988.

[24] Commission on Professionals in Science and Technology. Occasional Papers, prepared by Betty M. Vetter. *Look Who's Coming to School* (89-0), December 1988. *Women in Science. Progress and Problems* (89-1), February 1989. *Recruiting Doctoral Scientists and Engineers* (89-2), February 1989. CPST, Washington, D.C.